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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of: Kyusik Sin, et al.  
Patent No.: 7,027,274 B1  
Issue Date: 04/11/2006  
For: SPIN-DEPENDENT TUNNELING  
READ/WRITE SENSOR FOR HARD DISK  
DRIVES

Serial No.: 09/943,859  
Filing Date: 08/30/2001  
Examiner: Tianjie Chen  
Docket No.: K35R1694

REQUEST FOR CERTIFICATE OF CORRECTION  
PURSUANT TO 35 U.S.C. § 254

ATTN: Certificate of Correction Branch  
Commissioner for Patents  
P.O. Box 1450  
Arlington, VA 22313-1450

**Certificate**

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**of Correction**

Dear Sir/Madam:

The following errors were noted in the above-referenced patent. Applicant hereby requests that the Commissioner issue a Certificate of Correction, without charge.

**In the Claims:**

Column 8, Line 4:

Please delete "is". Enclosed as Exhibit A is a copy of the amendment filed 10/18/2005, which shows the correct wording of amended Claim 6.

A Certificate of Correction (PTO/SB/44) is enclosed. No fee is believed to be due. However, the Commissioner is hereby authorized to charge payment of any

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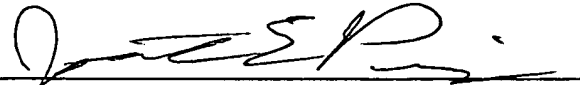
Patent No.: 7,027,274 B1  
Issue Date: April 11, 2006

Request for Certificate of Correction  
Attorney Docket No.: K35R1694

required fees associated with this communication or credit any overpayment to Deposit Account No. 23-1055.

Respectfully submitted,

Date: December 22, 2006

By:   
Jonathan E. Prejean, Esq.  
Reg. No. 52,132

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**UNITED STATES PATENT AND TRADEMARK OFFICE  
CERTIFICATE OF CORRECTION**Page 1 of 1

PATENT NO. : 7,027,274 B1  
APPLICATION NO.: 09/943,859  
ISSUE DATE : April 11, 2006  
INVENTOR(S) : Kyusik Sin, et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Col. 8, Line 4: Delete "is".

**MAILING ADDRESS OF SENDER (Please do not use customer number below):**

WESTERN DIGITAL TECHNOLOGIES, INC.  
Attn: Docketing, Location E118-G  
20511 Lake Forest Drive  
Lake Forest, CA 92630

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

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## EXHIBIT A

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**COPY** PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Appln. of: Sin et al.

Serial No.: 09/943,859

Filing Date: 08/30/2001

For: Spin-Dependent Tunneling Read/Write  
Sensor for Hard Disk Drives

Art Unit: 2652

Examiner: Chen

Confirmation No.: 2190

Docket No.: 1012-  
003/K35R1694

**RESPONSE TO OFFICE ACTION**

MAIL STOP AMENDMENT  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

In response to the non-Final Office Action mailed on July 19, 2005 for the above-identified patent application, please consider the following amendments and/or remarks.

A listing of all pending claims showing all amendments begins on page 2 of this paper.

**Remarks/Arguments** begin on page 8 of this paper.

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**Listing of Claims:**

1. (Previously presented) A method for manufacturing a hard bias spin-dependent tunneling sensor comprising:  
forming a first lead;  
forming a first gap spacer adjacent the first lead  
forming a hard magnet over the first lead, and around and in contact with the first gap spacer;  
forming a free layer over the hard magnet;  
forming a tunneling barrier layer over the free layer;  
forming a first pinned layer over the tunneling barrier layer and overhanging the hard magnet;  
forming a nonmagnetic coupling layer over the first pinned layer;  
forming a second pinned layer over the nonmagnetic coupling layer;  
forming a pinning layer over the second pinned layer; and  
forming a second lead over the pinning layer.
2. (Previously presented) The method as claimed in claim 1 including:  
forming the first gap spacer over the first lead; and  
forming a second gap spacer over the pinning layer whereby the free layer is equidistant from the first and second leads.
3. (Previously presented) The method as claimed in claim 1 including:  
forming the first gap spacer uses a bilayer process.
4. (original) The method as claimed in claim 1 wherein:  
forming the first lead includes using a bilayer process in forming a recess therein;  
forming the hard magnet includes forming a seed layer in the recess of the first lead; and  
forming the hard magnet includes forming a hard biasing material over the seed layer.

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5. (original) The method as claimed in claim 1 wherein:  
forming the free layer, the tunneling barrier layer, the first pinned layer, the nonmagnetic coupling layer, and the pinning layer includes using a bilayer process;  
and including:  
forming an insulator over the hard magnet and around the free layer, the tunneling barrier layer, the first pinned layer, the nonmagnetic coupling layer, the second pinned layer and the pinning layer.
6. (Currently amended) A method for manufacturing a hard bias spin-dependent tunneling sensor comprising:  
providing a substrate;  
forming over the substrate, a shield/first lead of a conductive material;  
forming a first gap spacer adjacent the shield/first lead;  
forming over the shield/first lead, a hard magnet containing a material selected from a group consisting of cobalt, chrome, platinum, tantalum, and a combination thereof, the first hard magnet being is formed around and in contact with the a first gap spacer;  
forming over the hard magnet, a free layer containing a material selected from a group consisting of cobalt, iron, nickel, and a combination thereof;  
forming over the free layer, a tunneling barrier layer containing a material selected from a group consisting of aluminum, chromium, an oxide, a nitride, and a combination thereof;  
forming over the tunneling barrier layer and overhanging the hard magnet, a first pinned layer containing a material selected from a group consisting of cobalt, iron, nickel, and a combination thereof;  
forming over the first pinned layer, a nonmagnetic coupling layer containing ruthenium;  
forming over the nonmagnetic coupling layer, a second pinned layer containing a material selected from a group consisting of cobalt, iron, nickel, and a combination thereof;

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forming over the second pinned layer, a pinning layer containing a material selected from a group consisting of platinum, palladium, manganese, iron, nickel, iridium, an oxide, and a combination thereof; and

forming over the pinning layer, a shield/second lead of a conductive material.

7. (Previously presented) The method as claimed in claim 6 including:  
forming over the shield/first lead, the first gap spacer from a nonmagnetic and conductive material; and  
forming over the pinning layer, a second gap spacer from a nonmagnetic and conductive material whereby the free layer is equally spaced from the shield/first lead and the shield/second lead.

8. (Previously presented) The method as claimed in claim 6 wherein:  
forming the first gap spacer uses a bilayer process.

9. (original) The method as claimed in claim 6 wherein:  
forming the shield/first lead includes using a bilayer process in forming a recess therein;  
forming the hard magnet includes forming a seed layer in the recess of the shield/first lead;  
forming the hard magnet includes forming a hard biasing material over the seed layer; and  
forming the free layer forms the free layer in contact with the hard magnet.

10. (original) The method as claimed in claim 6 wherein:  
forming the free layer, the tunneling barrier layer, the first pinned layer, the nonmagnetic coupling layer, and the pinning layer includes using a bilayer process;  
and including:  
forming an insulator over the hard magnet and around the free layer, the tunneling barrier layer, the first pinned layer, the nonmagnetic coupling layer, the second pinned layer and the pinning layer.

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11. (Currently amended) A hard bias spin-dependent tunneling sensor comprising:

- a first lead;
- a first gap spacer adjacent the first lead;
- a hard magnet over the first lead, the hard magnet formed around and in contact with the a first gap spacer;
- a free layer over the hard magnet;
- a tunneling barrier layer over the free layer;
- a first pinned layer over the tunneling barrier layer and overhanging the hard magnet;
- a nonmagnetic coupling layer over the first pinned layer;
- a second pinned layer over the nonmagnetic coupling layer;
- a pinning layer over the second pinned layer; and
- a second lead over the pinning layer.

12. (Previously presented) The sensor as claimed in claim 11 including:  
the first gap spacer over the first lead; and  
a second gap spacer over the pinning layer whereby the free layer is equally spaced from the first and second leads.

13. (Canceled).

14. (original) The sensor as claimed in claim 11 wherein:  
the first lead has a recess provided therein;  
a seed layer in the recess of the first lead; and  
the hard magnet is formed over the seed layer.

15. (original) The sensor as claimed in claim 11 including:  
an insulator over the hard magnet and around the free layer, the tunneling barrier layer, the first pinned layer, the nonmagnetic coupling layer, the second pinned layer, and the pinning layer.

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16. (Previously presented) A hard bias spin-dependent tunneling sensor comprising:

- a substrate;
- a shield/first lead of a conductive material over the substrate;
- a first gap spacer adjacent the shield/first lead
- a hard magnet containing a material selected from a group consisting of cobalt, chrome, platinum, tantalum, and a combination thereof over the shield/first lead, the hard magnet formed around and in contact with the first gap spacer;
- a free layer containing a material selected from a group consisting of cobalt, iron, nickel, and a combination thereof over the hard magnet;
- a tunneling barrier layer containing a material selected from a group consisting of aluminum, chromium, an oxide, a nitride, and a combination thereof over the free layer;
- a first pinned layer containing a material selected from a group consisting of cobalt, iron, nickel, and a combination thereof over the tunneling barrier layer and overhanging the hard magnet;
- a nonmagnetic coupling layer containing ruthenium over the first pinned layer;
- a second pinned layer containing a material selected from a group consisting of cobalt, iron, nickel, and a combination thereof over the nonmagnetic coupling layer;
- a pinning layer containing a material selected from a group consisting of platinum, palladium, manganese, iron, nickel, iridium, an oxide, and a combination thereof over the second pinned layer; and
- a shield/second lead of a conductive material over the pinning layer.

17. (Previously presented) The sensor as claimed in claim 16 including:  
the first gap spacer of a nonmagnetic, hard, conductive material over the shield/first lead; and

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a second gap spacer of a nonmagnetic, hard, and conductive material whereby the free layer is equidistant from the shield/first lead and the shield/second lead.

18. (Canceled).

19. (original) The sensor as claimed in claim 16 wherein:

the shield/first lead has a recess provided therein;

and including:

a seed layer in the recess;

and wherein:

the hard magnet is formed over the seed layer; and

the free layer is formed in contact with the hard magnet.

20. (original) The sensor as claimed in claim 16 including:

an insulator over the hard magnet and around the free layer, the tunneling barrier layer, the first pinned layer, the nonmagnetic coupling layer, the second pinned layer and the pinning layer.

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### REMARKS

Claims 1-12, 14-17, and 19-20 are pending. Claims 6 and 11 are indicated as being objectionable for informalities. Claims 1, 2, 6-7, 11-12, 15-17, and 20 are rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Pat. No. 6,381,107 issued to Redon et al. ("*Redon*"). Claims 3-5, 8-10, 14, and 19 are rejected under 35 U.S.C. §103(a) as being obvious over *Redon* in view of U.S. Pat. No. 6,495,311 issued to Khan et al. ("*Khan*"). Applicants respectfully traverse these rejections and respectfully request reconsideration of all claims in light of the following arguments.

### AMENDMENTS TO THE CLAIMS:

Applicants amend Claims 6 and 11 solely to correct typographical errors and the resulting informalities deemed objectionable by the Examiner on p. 2 of the Office Action. No substantive changes have been introduced by these amendments. Applicants respectfully request withdrawal of the objections.

### REJECTIONS UNDER 35 USC 102(e):

Independent Claims 1, 6, 11, and 16 each recite "a hard magnet" formed "around and in contact with the first gap spacer" and "a first pinned layer" that is "overhanging the hard magnet," a feature illustrated in Figure 4 of the application as originally filed. *Redon* fails to describe, either expressly or inherently, that the pinned layer 40 of *Redon*, used by the Examiner to show the recited first pinned layer, overhangs the hard magnet 61 of *Redon*, used by the Examiner to show the recited hard magnet. Thus, *Redon* does not anticipate Claims 1, 6, 11, and 16.

Moreover, the recited first pinned layer would not have been obvious from the teaching of *Redon*. *Redon* specifically teaches that the spacing D between the pinned layer 20 and the hard magnet 61 is "preferably ... no less than 0.02 [microns]" (col. 6, lines 48-49) to avoid "extra current channel effect" that "lower[s] the TMR ratio" (col. 5, line 43). Thus, *Redon* clearly teaches away from modifying the pinned layer 40 to overhang the hard magnet 61, and thus, *Redon* would not render such a modification obvious. Applicants also refer the Examiner to Applicants' arguments presented at pp.

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10-11 of the communication sent by Applicants on October 23, 2004 in response to the Final Office Action mailed August 23, 2004, which have not yet been answered by the Examiner. For at least the foregoing reasons, independent Claims 1, 6, 11, and 16 and their respective dependent claims are allowable over *Redon*, and accordingly Applicants respectfully request reconsideration and withdrawal of the claim rejections based on *Redon*.

REJECTIONS UNDER 35 USC 103(a):

Claims 3-5, 8-10, 14, and 19 each depend directly or indirectly on one or more claims that are allowable over *Redon* for at least the foregoing reasons. *Khan* provides no additional teaching regarding a pinned layer overhanging a hard magnet over and above that of *Redon*, and as noted above, even if *Khan* did teach such a modification to the pinned layer, *Redon* would teach away from applying that teaching to extend the pinned layer 40 of *Redon*. Thus, the *Redon-Khan* combination fails to render Claims 1, 6, 11, and 16 or their respective dependent claims obvious, and accordingly, Applicants respectfully request reconsideration and allowance of all of these claims.

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### CONCLUSION

In view of the foregoing amendments and/or remarks, Applicants respectfully submit that the pending claims are now in condition for allowance and respectfully request reconsideration and allowance of all pending claims. If it is believed that a telephone conversation would expedite the prosecution of the present application, or clarify matters with regard to its allowance, the Examiner is invited to contact the undersigned attorney at the number listed below.

The Commissioner is hereby authorized to charge payment of any required fees associated with this Communication or credit any overpayment to Deposit Account No. 23-1209.

Respectfully submitted,

Date: 10/18/05

By:   
Jonathan E. Prejean, Esq.  
Reg. No. 52,132

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